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PREPARATIONS FOR THE SEVENTH SESSION OF THE COMMISSION ON SUSTAINABLE DEVELOPMENT

Addendum

Activities of the United Nations Environment Programme regarding oceans management

Report of the Executive Director

Summary

The present report and its annex, prepared pursuant to Governing Council decisions 19/14 (C) of 7 February 1997 and SS.V/3 of 22 May 1998, highlights activities of the United Nations Environment Programme (UNEP) in the field of oceans management, as identified in chapter 17 of Agenda 21, and is submitted for consideration by the Governing Council as a major contribution of UNEP to the Commission on Sustainable Development at its seventh session.

* UNEP/GC.20/1.

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Suggested action by the Governing Council

The Governing Council may wish to:

Authorize the Executive Director to finalize the report on UNEP and the implementation of chapter 17 of Agenda 21, on the basis of the draft report contained in the annex to the report of the Executive Director 1/ and the comments made at the Council thereon, and to transmit it to the Commission on Sustainable Development at its seventh session.

BACKGROUND

1. In its decision 19/14 C of 7 February 1997, the Governing Council invited the Executive Director, within the programme of UNEP and in collaboration with the other United Nations agencies and world bodies represented on the Administrative Committee on Coordination (ACC) Subcommittee on Oceans and Coastal Areas, to provide the necessary support to the Commission on Sustainable Development in carrying out the periodic review of the world's marine environment called for in its decision 4/15. In addition, in its decision SS.V/3 of 22 May 1998, the Governing Council requested the Executive Director to consult with Member States, particularly developing countries, on environmental aspects of oceans management with a view to submitting his report thereon as a contribution to the work of the Commission on Sustainable Development at its seventh session.

2. In response to those requests, UNEP has prepared a draft report on UNEP and the implementation of chapter 17 of Agenda 21, for consideration by the Governing Council. The draft report, contained in the annex to the present report, highlights the need for sustainable management and use of oceans and coastal areas, and the state of the environment and trends regarding oceans and coastal areas. It also identifies the environmental challenges and priority issues for coastal areas, as well as proposals for future UNEP actions to address those challenges. The draft report constitutes a major contribution of UNEP to the Commission on Sustainable Development at its seventh session. It will be revised as appropriate prior to the seventh session of the Commission, taking full account of comments received at the third meeting of the High-Level Committee of Ministers and Officials of UNEP and the twentieth session of the Governing Council.

3. In decision 19/14 C, the Governing Council also requested the Executive Director, in cooperation with the heads of other sponsor organizations of the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), to consider how that Group might most effectively contribute to the task.

4. Accordingly, and within the context of the assessment requirements of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, a need was identified for regular reviews of the state of the marine environment at the global level. The Global Programme of Action specifically identified GESAMP as one mechanism for developing

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1/ The present report.

scientific assessments of the impacts of land-based activities on the marine environment. At its twenty-sixth session, on the basis of a proposal from UNEP, GESAMP established a Working Group on Marine Environmental Assessments, designating UNEP as the lead agency. In addition, at its twenty-seventh session, GESAMP considered the plans for undertaking an overall assessment of the state of the marine environment by 2002 and an assessment on land-based activities by 1999. GESAMP also agreed to establish cooperative arrangements with the Global International Waters Assessment in areas of mutual interest for both assessments.

Annex

DRAFT REPORT ON UNEP AND THE IMPLEMENTATION OF CHAPTER 17 OF AGENDA 21

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I. SUSTAINABLE MANAGEMENT AND USE OF OCEANS AND COASTAL AREAS

1. For centuries the international approach to the oceans reflected the political and economic interests of two predominant uses of the sea: navigation and fishing. International environmental law and practices were based on the principles of unfettered national sovereignty over natural resources and absolute freedom of the seas beyond the three-mile territorial limit. Such an approach followed from the widely accepted ideas contained in Grotius's Mare liberum, published in 1609.

2. At the turn of the last century, there were relatively few multilateral or bilateral ocean-related agreements. The 1911 Treaty for the Preservation and Protection of Fur Seals seems to have been the first multilateral agreement concluded to protect commercially valuable species. The important principle that countries have responsibilities for environmental damage to foreign countries that is caused by the transboundary effect of pollution originating within their borders was first clearly spelled out in the 1930s, in arbitration between Canada and the United States of America.

3. Preservation and conservation had emerged as conceptual frameworks for the management of natural resources in the 1940s, and resulted in a number of bilateral and multilateral agreements and arrangements dealing with fisheries. Modern agreements regulating and facilitating navigation date from the same period. But only during the last half of this century has it been gradually recognized that the world's oceans are more than shipping lanes and fishponds, and may need to be protected and regulated for a variety of multiple and potentially conflicting uses.

4. Marine pollution gained attention as an environmental issue only after the Second World War. Initially, attention was focused on petroleum hydrocarbons. With increasing maritime transport of petroleum hydrocarbons, the soiling of beaches by oil residues from ships' operational releases and tanker accidents became conspicuous and attracted the attention of the media, the general public and politicians alike. The International Convention for the Prevention of Pollution of the Sea by Oil was negotiated and signed, in 1954, to address the problem. During the 1960s, the Convention was followed by the negotiation of several additional conventions relating to interventions in case of oil pollution casualties and to civil liability and compensation for damage by oil pollution.

5. The preparations for the United Nations Conference on the Human Environment, held in Stockholm in 1872, gave a major boost to the development of additional international legal instruments. The protection of wetlands and sites considered as the natural heritage of mankind was covered by two global conventions: the 1991 Convention on Wetlands of International Importance, especially as Waterfowl Habitat (Ramsar Convention), and the 1972 Convention for Protection of the World Cultural and Natural Heritage. The need to protect the oceans from pollution other than oil gained recognition. The dumping of such pollutants was regulated by the 1972 Oslo Convention for the Prevention of Marine Pollution by Dumping and, as the sources and effects of pollutants entering the sea from land-based activities were considered highly region-specific, the first regional conventions dealing with their control were negotiated and adopted, such as the 1969 Bonn Agreement for Cooperation in Dealing with Pollution of the North Sea by Oil.

integrated whole; that the United Nations Convention on the Law of the Sea provides the international basis upon which to pursue the protection and sustainable development of the marine and coastal environment and its resources; and that new approaches to marine and coastal area management and development are required that are integrated in content and are precautionary and anticipatory in ambit.

16. Accordingly, it elaborated seven programme areas on which the protection and development of oceans and coastal areas should be focused:

(a) Integrated management and sustainable development of coastal areas, including exclusive economic zones;

(b) Marine environmental protection;

(c) Sustainable use and conservation of marine living resources of the high seas;

(d) Sustainable use and conservation of marine living resources under national jurisdiction;

(e) Addressing critical uncertainties for the management of the marine environment and climate change;

(f) Strengthening international, including regional, cooperation and coordination; and

(g) Sustainable development of small islands.

17. From the standpoint of oceans and coastal areas, equally important recommendations are to be found in other chapters of the Agenda, notably those related to: integrating environment and development in decision-making; protecting and promoting human health; conservation of biological diversity; management and use of freshwater resources; and management of toxic chemicals, hazardous wastes, solid wastes and sewage-related issues.

18. Among the main issues which emerged and divided the countries during the preparations for the Conference and the negotiation of the conventions on biological diversity and climate change was the issue of equity: was environmentally sustainable development for present and future generations to be financed? Nowhere was this issue more manifest than during the negotiation of agreements dealing with subjects which strongly polarized the views and interests of developing and developed countries. Thus, during the negotiation of the Convention on Biological Diversity and the Framework Convention on Climate Change, the common goal to be achieved by these conventions was not questioned. Sharp differences did arise, however, on how these goals were to be achieved in view of the different priorities assigned to them by different countries. The question of financial assistance for implementation of the conventions by developing countries was a particular bone of contention.

19. The inability (or unwillingness) of developing countries to meet their obligations without considerable financial assistance was recognized and - realizing that those conventions could not be implemented without their cooperation - the developing countries made their participation conditional on the availability of new and additional financial resources enabling them to meet the conventions' obligations. Anticipating such problems, the Global Environment Facility (GEF) was launched in 1991, by the agencies, organizations and countries with a particular interest that the conventions should be effectively implemented. Currently, GEF serves as a financial mechanism that provides grants and concessional funds to developing countries for projects designed to protect the global environment, with a focus on projects relevant to the Convention on Biological Diversity and the Framework Convention on Climate Change. Unfortunately, neither the Convention on the Law of the Sea or any other of the ocean-related conventions carries the same weight with GEF, and ocean-related projects are castaways where GEF is concerned.

20. Following the adoption of Agenda 21 in 1992, and in the spirit of recommendations made at the Earth Summit in Rio, considerable further progress was made in strengthening international efforts in the management and use of oceans and coastal areas. In 1993, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, the Convention on Biological Diversity and the Framework Convention on Climate Change entered into force, followed by the Convention on the Law of the Sea, in 1994. In 1994, the Programme of Action for the Sustainable Development of Small Island Developing States was adopted, followed, in 1995, by the adoption of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, the Code of Conduct for Responsible Fisheries and the Agreement on the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. In 1996, the Protocol to the London Convention was adopted which, once in force, will replace the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter.

21. The Global Programme of Action for the Protection of the Marine Environment from Land-based Activities is of particular importance for furthering the goals of Agenda 21, as it represents the first all-embracing blueprint for sustained and effective action to deal with all land-based impacts upon the marine environment. It envisages: the development and implementation of national action programmes; cooperation to build capacities and mobilize resources for the implementation of such programmes; promoting access to cleaner technologies, knowledge and expertise to address land-based activities, and available management tools; cooperation on a regional basis; and the establishment of a clearing-house mechanism to provide decision makers with direct access to relevant sources of information, experience and expertise. The development of a global, legally binding instrument for the reduction and elimination of emissions and discharges is identified as a further goal of the Programme, with special attention to elimination of the production and use of persistent organic pollutants.

22. Agenda 21 also gave new impetus to the development or strengthening of existing science-based programmes directly relevant to the management of oceans and coastal areas. The International Geosphere-Biosphere Programme

(IGBP), launched by the International Council of Scientific Unions (ICSU) in 1986, is of particular interest from a long-term perspective. Its overall goal is to describe and understand the interactive physical, chemical and biological processes that regulate the total Earth system, the unique environment that it provides for life, the changes that are occurring in this system, and the manner in which they are influenced by human activities. Areas of special relevance to the management of oceans and coastal areas include: improved global change predictions; the scientific analysis of available strategies for mitigation of global environmental change; and strengthening the capacity of scientists in developing countries.

23. The IOC-coordinated Global Ocean Observing System (GOOS), coordinated by the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO) is of more immediate and practical relevance to managers and policy makers. Its main goal is to ensure, through systematic observations, data and information, support to improved decision-making and resource management. The value and importance of GOOS were explicitly recognized in Agenda 21.

24. The Global International Water Assessment is a recent programme, approved in late 1997, which is supported by GEF. Its overall objective is to develop a comprehensive strategic framework for the identification of priorities for remedial and mitigation actions in international waters, including riverbasins. The Assessment is envisaged as a set of regional analyses of water-related problems and their social and economic causes (policies, governance, economic and information failures, etc.).

II. ROLE AND ACTIONS OF UNEP IN FACILITATING THE IMPLEMENTATION OF CHAPTER 17

A. Legislative authority

25. The legislative authority of UNEP to deal with the protection of oceans is derived mainly from recommendations of two global conferences, namely, the 1972 Stockholm Conference on the Human Environment and the 1992 United Nations Conference on Environment and Development, recommendations of other intergovernmental meetings, such as the meetings which adopted various regional seas programmes, the meeting which adopted the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, and other sources. It is the relevant resolutions of the General Assembly and decisions of the UNEP Governing Council, however, which constitute the only formally binding legislative authority for activities described in the next section of this chapter.

B. Focus of UNEP ocean-related activities

26. Most UNEP activities relevant to the management of oceans and coastal areas which predate the adoption of Agenda 21, such as the regional seas programme, the Global Environment Monitoring System (GEMS), the global environmental information exchange network (INFOTERRA) and Earthwatch, were recognized and endorsed by the Rio Summit as contributing to the implementation of Agenda 21. The only new activity specifically requested from UNEP was the convening of an intergovernmental meeting on the protection

of the marine environment from land-based activities. With that in mind, UNEP continued to implement its ocean-related programmes with some adjustments of their scope and direction, in order to increase the emphasis on approaches advocated by Agenda 21.

27. The regional seas programme, initiated in 1974, remained the central UNEP programme providing the major legal, administrative, substantive and financial framework for the implementation of Agenda 21, and its chapter 17 in particular. The regional seas programme is based on periodically revised action plans adopted by high-level intergovernmental meetings and implemented, in most cases, in the framework of legally binding regional conventions, under the authority of the respective contracting parties or intergovernmental meetings.

28. Currently, 12 regions are covered by adopted action plans and nine of the action plans are supported by regional conventions. The geographic regions considered as covered by the regional seas programme include: the Mediterranean; west and central Africa; the wider Caribbean; eastern Africa; the east Asian seas; the south Asian Seas; the north-west Pacific; the Persian and Arabian Gulf; the south-east Pacific; the south Pacific; the Red Sea; and the Black Sea. UNEP provides the secretariat of the programmes in the first seven regions listed. Programmes in nine of the regions are implemented in the framework of corresponding regional conventions.

29. Two of those action plans were adopted after 1992, following the recommendation of the Rio Summit to extend the regional seas programme to those new regions where it might be appropriate. More than 140 countries participate in the action plans, through the involvement of about 400 national institutions. Active support to the programme is provided by a large number of international, intergovernmental and non-governmental organizations participating in its implementation.

30. Whenever appropriate, the regional seas programme is used as the main mechanism to implement the various ocean-related activities of UNEP. The overall coordination of the regional seas programme by UNEP ensures that such activities, although implemented regionally, remain essentially global in nature.

31. While the focus of the first action plans was on the protection of the marine environment against pollution, plans adopted subsequently shifted their priorities to the development and protection of the marine and coastal environment. Revisions of the action plans made since 1992 have broadened their scope so as to emphasize issues related to the integrated management and use of coastal and marine environment, along the lines recommended by Agenda 21. The protection and management of fisheries resources is the only major item excluded from consideration in the framework of the regional seas programme. A further positive development was the establishment, in one of the regions - the Mediterranean - of a regional commission for sustainable development, as a subsidiary body of the parties to the Barcelona Convention. The establishment of a similar body, as a joint subsidiary body of the Abidjan and Nairobi conventions, is in progress. In addition, work is under way on a review of the Nairobi Convention with a view to its eventual amendment.

32. This evolution of the regional seas programme prompted UNEP to assume one of the lead roles in promoting the concept of integrated coastal area management. Comprehensive coastal area management plans have been and are being developed in the framework of several regions covered by the regional seas programme (in Albania, Algeria, Croatia, Egypt, Israel, Lebanon, Malta, Morocco, the Syrian Arab Republic, Tunisia, Turkey and elsewhere), frequently in collaboration with the World Bank and other intergovernmental and non-governmental organizations. Based on the experience accumulated through these coastal area management plans, detailed guidelines for the integrated management of coastal and marine areas and for an integrated approach to the development, management and use of coastal water resources were published in 1995 and 1997, respectively, and guidelines for integrated coastal area and river basin management are being developed. As a related activity, the Atlas of Coastal Resources of Kenya was prepared and published in 1998.

33. The Global Plan of Action for the Conservation, Protection and Utilization of Marine Mammals was originally prepared between UNEP and the Food and Agriculture Organization of the United Nations (FAO), in the late 1970s. It was subsequently endorsed by the International Whaling Commission and its Scientific Committee, to serve as a framework for policy planning and programme formulation by international community. In 1997, the Plan of Action was revised but, owing to financial constraints, its implementation is in abeyance.

34. UNEP is actively participating in the implementation of the Programme of Action for the Sustainable Development of Small Island Developing States, adopted in Barbados in 1994, to address the specific social, economic and environmental problems of such States.

35. Some of the major UNEP programme elements, such as INFOTERRA, Earthwatch, GEMS and the Global Resource Information Database (GRID), have also made considerable contributions to the implementation of chapter 17. These include assessment and monitoring of coastal suspended sediment concentration and vegetation conditions in the South China Sea; vegetation mapping of the coastal zone of Cambodia; application of the geographical information system (GIS) to coastal and marine resources for Hainan, China; pollution management in the Saigon river estuary; assistance to Maldives and Sri Lanka in enhancing their capacities for environmental assessment, including the provision of equipment and training; capacity-building for data and information management in eight Black Sea countries; two volumes of the Global Environment Outlook (GEO) report series, covering, inter alia, ocean-related issues; and a GEO small island developing States project to address the specific problems of these States. Further details on the Barbados Programme of Action can be found in the draft on its implementation, prepared for the Commission on Sustainable Development at its seventh session and contained in document UNEP/GC.20/19.

36. UNEP, as one of the implementing agencies of GEF, is specifically responsible for catalysing the development of scientific and technical analysis and advancing environmental management in GEF-financed activities. It provides guidance on relating these activities to global, regional and national assessments, policy frameworks and plans, and to international

environmental agreements. UNEP also manages the Scientific and Technical Advisory Panel (STAP), an independent advisory body that provides scientific and technical guidance to GEF.

37. As one of the agencies sponsoring GESAMP, which brings together experts from the International Maritime Organization (IMO), FAO, IOC, the World Meteorological Organization (WMO), the World Health Organization (WHO), the International Atomic Energy Agency (IAEA), the United Nations and UNEP, UNEP actively participated in, and financially supported, the preparation of the GESAMP studies dealing with a variety of issues. UNEP had had a particular interest in the preparation of comprehensive periodic reports assessing the state of the global marine environment. Currently, UNEP leads the preparation of the third such report. Chapter III and IV of the present document are largely based on material which is being considered for eventual inclusion in that report.

38. In addition to the activities listed here, UNEP is continuing to contribute to the implementation of chapter 17 of Agenda 21 through the Intergovernmental Panel on Climate Change (IPCC), established jointly with WMO, and through various activities undertaken in the framework of several conventions for which UNEP provides the secretariat, namely: the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES); the Convention for the Conservation of Migratory Species of Wild Animals; the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal; and the Convention on Biological Diversity.

39. UNEP is also co-sponsor and active participant in a large number of programmes and activities led by other organizations. Those of particular relevance for the implementation of chapter 17 of Agenda 21 are: the International Coral Reef Initiative (ICRI), involving IOC, UNEP and the World Conservation Union (IUCN); the Global Ocean Observing System (GOOS) - IOC, UNEP, WMO and others; the Global Investigation of Pollution in the Marine Environment (GIPME) - IOC, UNEP and IMO; and the World Climate Programme (WCP) - WMO, UNEP, UNESCO, FAO and the International Council of Scientific Unions (ICSU).

40. Among the new activities flowing from the recommendations of the Rio Summit, UNEP prepared and convened the intergovernmental meeting which adopted, in late 1995, the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities. The final implementation plan for the Programme was endorsed by the Governing Council in 1997. Regional workshops were or are being organized in the framework of the regional seas programme to identify regional problems and priorities for action, and to initiate the development of regional strategic programmes to address land-based activities. The preparation of detailed overviews of problems related to land-based activities is under way for each of the regions covered by the Global Programme. Under the leadership of UNEP, the results of these regional overviews are being synthesized into a global report on the impact of land-based activities by GESAMP. The clearing-house which it is planned to establish under the Global Programme of Action is being developed in cooperation with organizations designated as having a specific role to play. A strategy paper outlining the plans for further implementation of the Global Plan of Action has been prepared by UNEP and discussed in informal consultations with Governments and agencies.

Discussion of the paper with non-governmental organizations is scheduled for November 1998. UNEP, as the designated secretariat of the Global Programme of Action, established the coordination office of the Programme in The Hague in 1997, with the generous support of the Government of the Netherlands.

41. The Global International Waters Assessment has a GEF-funded four-year project, coordinated by UNEP, which has recently been approved. The project will focus on five critical issues of coastal waters and associated river basins: water scarcity; pollution; habitat modification and destruction; over-exploitation of fisheries and other living aquatic resources; and globa changes. In addition to the identification of problems related to those issues, the project will also analyse their underlying root causes. The results of the project are expected to assist Governments and the GEF Counci in establishing priorities which may be addressed by subsequent GEF-funded activities. The city of Kalmar in Sweden offered to host the unit coordinating the project. The host Government agreement with the Government of Sweden and a memorandum of understanding with Kalmar University for the implementation of the Global International Water Assessment have been signed

42. Several specific contributions to observance of the Year of the Oceans were made by UNEP, or with contributions or assistance from it: a special issue of the UNEP magazine Our Planet was dedicated to oceans; a short "IMAX Trailer" was produced and is being shown in 75 theaters worldwide over a period of nine months; several in-flight videos and inputs into in-flight magazines have been developed and are being used by some major airlines, suc as KLM, Singapore Airlines and TAP; a special booklet presenting the regiona seas programme has been printed and widely distributed; posters, stickers, pocket calendars and postcards containing the UNEP message "Ocean for life o Earth - Save our Seas" have been produced and widely distributed; the UNEP magazine for children Leave it to Us was reissued in several languages, with a special focus on oceans; a children's art competition was organized, including oceans as one of its themes; a World Youth Declaration on Oceans was prepared and endorsed by the World Youth Forum (Braga, Portugal August 1998); a compact disc with songs on the theme of the oceans was released; si short documentary film highlighting global ocean issues were prepared in cooperation with TVE and broadcasted worldwide by BBC; a coffee-table album is being prepared in cooperation with Living Earth Foundation; the Turner Network (CNN and CNN International) broadcasted the UNEP ocean-related publi service announcements from mid-May through early June 1998; numerous press releases and interviews have been organized, and UNEP has either convened or participated in various meetings and conferences organized specifically to commemorate the Year of Oceans.

C. Sources of financial and human resources for environmental aspects of UNEP activities in coastal areas and oceans

43. Implementation of the UNEP ocean-related programme suffers from a chronic shortage of financial and human resources. Since the resources derived from the Environment Fund of UNEP, and those available through the regional trust funds directly supporting the regional seas programme, are to limited to cover the requirements of the programme, UNEP sought to mitigate the problem through various arrangements involving Governments, donor agencies, intergovernmental organizations and mechanism, as well as non-governmental organizations.

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44. A growing number of UNEP activities are being implemented and co-financed through partnership arrangements with Governments, intergovernmental, international and non-governmental organizations. For example: the Government of the Netherlands is supporting the Global Plan of Action; the Global International Water Assessment raised close to $6 million in counterpart contributions to match the $6.5 million provided by GEF and the $860,000 provided by the Environment Fund; the European Commission is supporting, to the tune of $567,000, the preparation of a joint European Union/UNEP state-of-the-environment report for small island developing States participating in the Lomé Convention; about $500,000 has been provided by the Government of Finland and close to $800,000 has been raised by the Advisory Committee on Protection of the Sea (ACOPS) to revitalize the coastal and marine programmes in sub-Saharan Africa, including the convening of ministerial conferences in Maputo (July 1998) and Cape Town (December 1998).

45. GEF has proved to be a major external source of funding for projects implemented by UNEP. Since 1994, a total of 14 projects related to the GEF international waters focal area have been approved, with a contribution from the GEF Trust Fund amounting to $20.6 million. Most of these funds were channelled to projects directly or indirectly supporting the regional seas programme, while some funds were used in response to the needs of the freshwater-related programme of UNEP. As a counterpart contribution to these projects, UNEP contributed $1.1 million in cash and about $600,000 million in kind. The cash and in-kind contributions from participating Governments and collaborating organizations to the same projects amounted to $15.2 million.

46. The financial constraints are particularly felt in the work of GESAMP, since UNEP is no longer in a position to provide adequate funding for major assessment reports and the sponsoring agencies are reluctant to follow up the relevant decisions of the Commission on Sustainable Development (decision 4/15) and the UNEP Governing Council (decision 19/14) which may mitigate the Joint Group's financial problems.

III. STATE OF THE ENVIRONMENT AND TRENDS IN REGARD TO OCEANS AND COASTAL AREAS

A. Overall assessment

47. Over the past decade, the nature of the environmental problems of the oceans and coastal areas and their causes, has remained largely unchanged at the global level. There have been some notable successes in addressing problems caused by specific forms of marine pollution, and more generalized successes in improving the environmental quality of coastal areas have been achieved in some geographic areas. On a global scale, however, the degradation of the oceans, coastal areas and their resources has continued and, in many places even intensified. The incidence and extent of human activities and interventions is on the increase and is felt over ever broader geographical areas. In many parts of the world, the traditional uses of the oceans and coastal areas, and the benefits derived from them, have been undermined.

48. It is now recognized that the main driving force of the problems is ill-planned coastal social and economic development. This awareness has led to a series of policy decisions, the launching of new research, observation and management programmes, a shift in the focus of action from sectoral to intersectoral approaches and the consideration of marine affairs as an integral part of coastal socio-economic development.

49. Four main issues emerged during the last decade which placed the protection of the oceans and coastal areas in a new perspective: first, the growing appreciation of the role of the ocean in the Earth's climate system and the impact which may be expected from climate change; second, the need for an integrated approach to the management of the marine and coastal environment, including associated river-basins and groundwater systems; third, the potential importance of marine and coastal biodiversity; and, fourth, the changing perceptions about the relative importance of various marine pollutants and other sources of degradation.

50. Some of the pollutants once considered to have the highest global importance are today considered less important, thanks to new research or effective control measures. Pollution by oil is today seen less as a global and more as a local problem, even in the case of accidental spills. Likewise, metals (including heavy metals) are now considered as a far smaller global problem than, for instance, persistent organic chemicals - or pollutants, compounds which may affect organisms at molecular or reproductive level, or nutrients. The debate about the relevance of anthropogenically introduced radionuclides into the marine environment still looms large in the minds of general public and, to a lesser extent, politicians. Although threats from accidental releases of radionuclides which may find their way into the marine environment cannot be ruled out, among the various categories of marine contaminants, radionuclides probably cause the least concern from a scientific standpoint.

51. The situation at regional and local levels has also changed. New information has alleviated some previous concerns, such as pollution of the Arctic. Significant reductions in the extent of pollution load have been achieved in many places and sectors by technical and administrative measures. Concerted action at international and national levels has reduced the quantities of oil discharged from ships and there is convincing evidence that, in certain geographical areas, better management of land-based activities has led to cleaner beaches and bathing waters, and sea-food that is safer to eat.

52. Land-based activities were recognized long ago as the most serious source of marine contaminants and, more generally, as a threat to the integrity of marine and coastal ecosystems. The earliest efforts to control marine pollution were primarily directed towards control of well defined point-sources along the coast. It is now realized that, in many instances, point-sources may not be the major source of certain pollutants and that pollution, as understood generally, is rivalled by other human activities which may have an even greater impact on natural environment. Perhaps the most important shift in the perspective has been the recognition that pollution is neither the only nor necessarily the most severe environmental threat to the health of oceans and coast: widespread, intensive habitat modification and resource exploitation, habitat loss, population decline and

the resulting changes in ecosystem functions probably pose even greater threats. Accordingly, the environmentally sound management of land-based activities is today seen as the most effective way to protect the marine environment and its resources.

53. The use of marine and coastal areas for subsistence, commerce and recreation is increasing and there is a growing demand for both renewable and non-renewable marine and coastal resources. The greatest pressures stem from population growth, urbanization, industry, agriculture, fisheries, transport, energy production and recreational activities, clearly signifying that the land-based activities predominate.

54. Waste entering the marine environment, although curbed in many parts of the world by improved technological processes and better waste management practices, is still on the rise globally. The worldwide use of agrochemicals - pesticides and fertilizers in particular - and the quantity of their residues entering the oceans are on increase.

55. Fisheries are in a shambles owing to gross mismanagement of their exploitation. Maritime transport is probably the only sector which, as a whole, has not significantly increased pressure on the health of the oceans in the last decade, although coastal navigation-related activities, such as the construction or expansion of harbours, have important environmental effects.

56. Growing areas of the narrow coastal terrestrial strip of land and its habitats suffer from poorly planned and regulated urbanization, industrialization, aquaculture, tourism, port development and flood control. Nearshore coastal waters, in semi-enclosed bays, seas and estuaries in particular, have suffered general decline over the last decade. The extension of drilling into deeper waters and the expansion of fisheries have increased the pressure on open shelf areas. Aside from the deterioration of commercially exploited fish stocks, however, the open oceans are still in a generally healthy state.

57. Although the nature and intensity of human pressures vary among and within different oceanic regions, their main effects can be generalized as the following:

(a) Degradation of water quality: While the diminished threat from some specific pollutants is now recognized, other forms of pollution from point and non-point sources still seriously degrade coastal waters, particularly in closed and semi-enclosed seas, estuaries and groundwater systems. Toxic chemicals, nutrients, pathogens, oxygen-demanding wastes, sediments - or silt, petroleum hydrocarbons and litter are among the most relevant pollutants. Polluted waters pose a considerable threat to public health, for example, through the ingestion of contaminated water or food, or exposure during recreational activities;

(b) Damage to ecosystems and loss of habitats: These are common and widespread in coastal and marine environments. The most affected systems are in rivers, estuaries and marine waters, adjacent to the coast. Pollution is not the only, or even the most important, culprit. Physical alteration and destruction of natural coastline and riverbanks - such as land reclamation,

deforestation, coastal construction, aquaculture - mining and destructive fishing practices are equally important. So are hydrological modifications, including large-scale irrigation schemes, the erection of dams and creation of reservoirs and changed land-use practices, which often lead to serious physical degradation of habitats and significant changes in ecosystems. Wetlands, mangroves, seagrass beds and coral reefs are particularly vulnerable. The increasing incidence of eutrophication of coastal waters and estuaries, and possibly of associated toxic algal blooms, are telling signs of spreading ecosystems degradation;

(c) Resource exploitation and overexploitation: Decline in fisheries resources, mainly due to overfishing and fishing with inappropriate techniques, for example, with non-selective fishing gear and the use of poisons or explosives, poor resource management, and questionable social and economic measures, are of concern for both freshwater and marine basins. Over-harvesting of tropical coastal resources is of particular significance in many developing countries; and

(d) Introduction of alien species: Non-indigenous species introduced intentionally or accidentally in an alien environment often seriously disrupt indigenous ecosystems and may adversely affect economic activities, such as fisheries, and may cause toxic and human health effects.

B. Special concerns

58. The issues and phenomena described in the following paragraphs, and their consequences for the environment, are of particular concern to oceans management.

1. Eutrophication

59. Eutrophication, i.e., increased primary productivity (growth of plant life) in response to artificially elevated input of nutrients, is among the most potentially damaging of all the many human influences on the oceans, both in terms of scale and consequences. The predominant anthropogenic sources of nutrients are agricultural activities, such as fertilizer residues, waste from animal husbandry and human sewage. The primary pathway of transport, on a global scale, are riverine and atmospheric, with the former predominant in the supply to inshore areas and the latter the dominant pathway for transport to the open ocean. The input of nutrients into the sea is on the increase globally and the negative impacts of eutrophication occur with increasing frequency in ever larger areas and a greater number of sites.

60. On local scales, eutrophication promotes the explosive growth of phytoplankton (algal blooms) and selectively favour the growth of toxic, or otherwise harmful species. Such blooms may have several adverse effects. The decay of phytoplankton biomass consumes oxygen dissolved in sea which may cause serious oxygen depletion leading to mass mortality of fish and other organisms. Blooms involving toxin-producing species may lead to very serious public health problems, when toxins are ingested through contaminated seafood. Although algal blooms occur naturally in many parts of the ocean, there is evidence that the global frequency of blooms is increasing.

61. In addition to promoting intense local algal blooms, eutrophication may have effects on larger scales. Long-term increases in phytoplankton productivity, and the resulting decay of organic matter in deeper waters, may result in periodic or permanent oxygen depletion over large areas, specially in coastal areas with reduced water circulation. Such anoxia, or simply the increased input of organic matter to the bottom, has the potential dramatically to alter bottom ecosystems.

62. Long-term increases in phytoplankton abundance also increase water turbidity, thereby reducing the penetration of sunlight to the bottom. This adversely affects light-dependent communities, such as seagrass beds and coral reefs. In the case of coral reefs, eutrophication also promotes the growth of bottom-living seaweeds at the expense of reef-building corals, resulting in profound changes in the structure and function of the reef.

2. Reduced nutrient flows

63. Just as excessive nutrient inputs can turn marine areas into wastelands, an artificial reduction in nutrient flow can adversely affect productivity and therefore fisheries. Large-scale dams, artificial freshwater reservoirs, and the withdrawal and diversion of freshwater flows for industrial and agricultural purposes reduce natural river inputs to the sea. The construction of the Aswan High Dam, for example, reduced the flow of the Nile by more than 97 per cent, with a concomitant reduction in nutrient inputs. This caused a 90 per cent reduction in sardine landings and 75 per cent in shrimp landings from waters adjacent to the Nile delta.

3. Increased or decreased inputs of sediments

64. Increased or decreased inputs of sediments (particles) carried by rivers or other runoff into the sea continue significantly to affect shoreline changes and habitats.

65. An increased supply of sediments from spreading deforestation, soil erosion, the large-scale moving of soils (building of dams, roads, etc.), or the diversion of water courses, raises the sedimentation rate along the coast. In many places this adversely affects wetlands and deltaic habitats, and bottom-dwelling communities of coastal waters, such as coral reefs and seagrass beds, by reducing light penetration and by covering them with silt.

66. Dams, artificial freshwater reservoirs and the withdrawal and diversion of freshwater flows for industry and agriculture reduce the natural supply of sediments to coastal waters, just as they reduce that of nutrients. This has led to major coastal erosion problems in many parts of the world. For instance, in the Indus delta, after the construction of barrages, the sediment loading was reduced by about 80 per cent, leading to rapid coastal erosion.

4. Marine pollution

67. Marine pollution stemming from the introduction of substances into the marine environment from human activities has, historically, been the predominant concern. An improved appreciation of the scale of other forms of damage and threats to the marine and coastal environment has resulted,

however, in more balanced perspectives of the severity of such classical pollutants. Pre-eminent among contemporary concerns about marine pollutants are nutrients (already discussed under eutrophication), endocrine disrupters, organochalogens, petroleum hydrocarbons - largely from major oil spills at sea - and, in a few cases, metallic compounds, such as mercury, cadmium, organotin and copper.

68. The discharge of solid and liquid human waste into coastal waters and in nearby coastal zone remains a major problem. Aside from being an aesthetic nuisance and ruining the amenity value of many coastal areas, it is a major source of nutrients, increases the health risk to bathers and consumers of marine foodstuff, and may interfere with fisheries and navigation. Outbreaks of cholera, typhoid and other illnesses are frequently traced to pathogen-contaminated seafood and bathing waters. The health risk is particularly high in areas where carriers of pathogens are common among the local population and the sewage treatment and disposal systems are inadequate.

5. Overfishing

69. Overfishing, i.e., fishing at rates that endanger the maintenance of the stock, is among the most severe problems presently facing marine fisheries. This practice results in reduced catches, excessive economic costs in harvesting, and reduced economic benefits from fisheries. Overfishing has reached serious levels, both in many high-sea fisheries and in coastal waters, particularly in regions with high population densities, a high local demand for fish and scarce employment opportunities.

70. Although, during the 1990s, fishing efforts increased, in general the total catch has not increased since the late 1980s. In 1996, the total world production of fish, crustaceans and molluscs reached a record level of almost 113 million tons (94.6 million tons of fish). Marine fisheries contributed about 87 million tons (77 per cent of total fisheries production and 92 per cent of marine fisheries), of which amount about 50 million tons was used for direct human consumption. Six species account for 25 per cent of total capture fishery production. In terms of tonnage, in 1996, fleets of seven countries (Chile, China, Indonesia, Japan, Peru, the Russian Federation and the United States of America), accounted for over half of the world's capture fishery.

71. In the mid-1990s, catches of about 35 per cent of the stocks were declining, 25 per cent were stable at a high level of exploitation, and 40 per cent were on increase. By contrast, in the early 1950s, 55 per cent of the fishery stocks were underexploited. There is a consensus that there is little scope for increasing catches by increasing fishing efforts, which would only result in lower catch rates in most currently exploited stocks.

72. The North-west Pacific remains by far the most productive fishing area. When known and traditional fish stocks and fisheries are taken into account, the total marine catches from most of the main fishing areas in the Atlantic Ocean and some in the Pacific Ocean seem to have reached their maximum potential years ago. For that reason, substantial catch increases from these areas are unlikely.

73. Overfishing is not the only problem associated with marine fisheries. It is estimated that in global commercial fisheries about 27 million tons of the biomass is wasted in the form of by-catch and discards which, in addition to fish, include also other groups of animals (invertebrates, reptiles, sea-birds and mammals). A number of important stocks appear to be particularly susceptible to the impact of large-scale natural changes such as those attributable to the El Niño phenomenon. Leaving aside their local and secondary effects, e.g., those caused by eutrophication, marine pollutants are not considered to pose a major problem for most commercial fisheries. Certain fishing practices, such as excessive trawling and dredging and fishing with explosives and poison, and with driftnets, have a considerable ecological impact and contribute to the physical and ecological degradation of coastal zones.

74. Fisheries problems can be traced to four main factors: first, many stocks, particularly in high-seas fisheries, are exploited on the basis of free and open access; second, in many countries fisheries are subsidized, making fishing more profitable than it would be without subsidies (a recent study estimated such subsidies as totalling at least $20 billion); third, some management systems may unintentionally encourage the overcapitalization of fishing industry; and, fourth, a weak commitment to international cooperation through existing fisheries bodies and agreements. The current system could be summarized as waste of labour, capital and fisheries resources.

75. Reducing subsidies for the fishing industry would seem to be a major avenue towards restoring the depleted stocks and turning fisheries into a sustainable activity. The results of some steps taken in this direction are encouraging. The fishing fleets of most developed countries show a long-term decrease in the number of vessels. If the current trend continues, the global fleet of fishing vessels above 100 gross register tons (GRT) will decrease by at least 40 per cent over the next ten years. The rate at which vessels over 100 GRT are built is on the decrease and was less than 200 in 1997. At the same time there are now more than 10,000 vessels over 20 years old. Over the next 10 years, most of these vessels are likely to be scrapped.

6. Habitat and ecosystem alteration

76. Increasing habitat and ecosystem alteration, either by physical (e.g., landfills, sedimentation), chemical (e.g., pollution) or biological (e.g., introduction of non-indigenous species) means, constitutes the most widespread, and frequently irreversible, human impact on the coastal zone. Coastal development, including spreading aquaculture, has considerably reduced the area previously covered by wetlands, marshes and mangroves, with an effect on wildlife communities inhabiting such areas. Only 30 per cent of the European coastline may be considered to be free from human alterations. An estimated 10 per cent of coral reefs and 40-50 per cent of the mangrove forests and seagrass beds have been lost already.

7. Introduction of non-indigenous species

77. The deliberate and accidental introduction of non-indigenous species is on the increase. The impact of such introductions ranges from wholesale ecosystem changes, extinction of indigenous species, human health effects, to more subtle changes in the composition and the function of indigenous ecosystems. The economic consequences of these invasions may be considerable. The situation created by jellyfish introduced in the Black Sea is one of the best documented examples of the far-reaching - almost catastrophic - ecological and economic consequences which may accompany the invasion of an alien species in an environment where natural conditions favour its apparently unlimited population growth. The decline in the value of fisheries catches alone was estimated as at least $300 million between the mid-1980s and the early 1990s.

7. Reduction of marine biodiversity

78. Until recently, it was generally thought that there are fewer species in the ocean than on the land. Recent studies of deep seabed communities - previously considered comparatively devoid of life - have revealed, however, that they alone may contain more species than occur on land. Localized extinctions of a number of species through overexploitation or habitat destruction are well known but the alarming rate at which terrestrial species are becoming extinct is fortunately not parallelled in marine species. Consequently, the reduction of marine biodiversity attracts less attention than terrestrial biodiversity, although it is gradually being recognized as an important issue.

8. Particularly vulnerable ecosystems and geographical areas

79. It is recognized that there are certain ecosystems or geographical areas which are particularly vulnerable or sensitive and, therefore, require special attention. The most prominent among these are the small islands, estuaries, coral reefs, seagrass beds, mangroves, coastal wetlands and spawning and nursery grounds of fish and crustaceans.

IV. MAJOR FUTURE ENVIRONMENTAL CHALLENGES AND PRIORITY ISSUES FOR OCEANS AND COASTAL AREAS

80. A host of problems, well recognized for decades, continues to remain on the agenda of environmental and political meetings. The nature and main causes of these problems are fairly well understood. The technical, economic, social and political options for their solutions are also fairly well understood and generally available, at a cost. Nevertheless, owing to the complexity of these problems and the conflicting interests involved, their effective solution generally eludes decision-makers and managers, in spite of the growing number of sectors and sites where substantive improvements have been achieved.

81. The major environmental problems currently besetting the oceans and coastal areas have been reviewed in the preceding chapter. Some of the sectoral solutions to the problems identified have also been indicated. This review has clearly demonstrated that the root causes of most problems are in

land-based activities. It can be stated, therefore, with full justification, that the impact of various land-based activities on marine and coastal environment is currently the single major focus of international attention. The issue is, of course, not new. Concerns about marine pollution and the degradation of coastal amenities originating from sources on land, about changes made in the coastline, and about the destruction of coastal habitats, have long been expressed by scientists and widely acknowledged by policy makers and the general public alike. Data made available during the last decade have, however, clearly indicated a general increase in the scale and type of land-based activities with deleterious impacts on the marine and coastal environment, both in the vicinity of major activities and at locations far removed from such activities.

82. Coastal urbanization, industrial development, drainage basin modifications, commerce and transport, tourism, agriculture, forestry and aquaculture are among the most important activities affecting the marine and coastal environment. Their impacts cannot generally be conclusively ascribed to individual sources or activities. In most cases, the impacts result from the cumulative effects of a variety of activities whose individual contributions vary from site to site and cannot always be traced to their origin with great certainty. Nevertheless, the nature and consequences of specific categories of land-based activities can be described in qualitative, and sometimes quantitative, terms.

83. Owing to the complex nature of the impact of land based activities, and the pervasiveness of economic externalities dominating the environmental aspects of these activities, solutions to their associated environmental problems cannot be found through the conventional sectoral approach to resource management. Today it is generally recognized that that approach must be replaced by a cross-sectoral, or holistic, integrated coastal area management (ICAM), encompassing all coastal (terrestrial and maritime) activities and extending also to the catchment areas of their associated river-basins and the underlying groundwater systems.

84. While ICAM is conceptually simple, its implementation is difficult. The setting of goals and objectives calling for reconciliation of different interest may frequently result in some interests being required to forgo economic or other benefits, in order for other groups to benefit from a specific resource or resources. Consequently, ICAM is essentially and primarily a political process in which goals and objectives, and the policies to meet these objectives, need to be determined by those with political constituencies.

85. Aside from the sectoral approach which still largely prevails in coastal zone management, a major conceptual problem is nested in lack of proper understanding that ICAM must also include management of river basins associated with coastal zones. In spite of their obvious ecological, economic and social interdependence, the need for adopting drainage basins as units of ICAM is still not appreciated adequately, although several key factors strongly militate against the treatment of coastal zones and river basins as independently manageable entities. Widespread hydrological modifications, such as the diversion of watercourses, construction of impoundments and barriers and irrigation schemes, interfere with the dynamic balance of coastal zone, encourage coastal erosion and wetland loss, modify

coastal ecosystems dependent on nutrient inflow, and impair the life-cycle and reproduction of fish migrating between marine and freshwater environments, such as salmon.

86. The need to include groundwater in ICAM is generally ignored, although groundwater has an important bearing on the hydrological regimes of drainage basins, as well as on human health (pollution) and well-being (water supply).

87. The obstacles to be overcome in order to adopt responsible policies related to ICAM are numerous. They include the unwillingness to alienate certain economic or political interests; the lack of understanding of how to implement such policies; the reluctance to modify existing institutional arrangements; the mistaken perception that such policies cannot be afforded; the lack of understanding of the economic value of coastal and marine resources which takes into account their ecological functions; and the absence of constituencies appreciating sustainable management of coastal and marine areas.

88. Aside from the listed obstacles of a political nature, the effectiveness of ICAM may be constrained in many countries by the scarcity - or total lack - of funding, both for capital projects and for the initiation of certain activities, or of relevant managerial or technical skills. The importance of these constraints cannot be underestimated.

89. Weaknesses in fisheries management are among major persistent problems (reviewed in the preceding chapter) that must be solved in order to ensure the ecological, economic and social sustainability of fisheries. Solutions should be sought primarily through a reduction of over-capacities in fisheries and a reduction of the by-catch, in particular of endangered species.

90. As a result of an improved insight into certain perennial problems, or in the light of recent or foreseeable developments, several issues have been identified during the last decade as requiring closer attention.

91. Increased efforts should be devoted to clarify the potential effects of substances which may affect the composition and functioning of coastal and marine ecosystems and populations of organisms (e.g., population behaviour and reproductive effects), or influence molecular level processes (e.g., carcinogenesis, mutagenesis, teratogenesis and disruption of endocrine functions). Although the evidence for the effects ascribed to the currently occurring concentration of such substance in the marine and coastal environment is in most cases inconclusive, there are indications that these effects may indeed exist and could have potentially adverse effects, including on human health through the consumption of seafood. Substances of particular concern are those released from aquaculture and chemicals that affect endocrine systems and functions (endocrine disruptors).

92. By virtue of their nature, there is a continuing accumulation of persistent organic compounds in deep-sea sediments which act as their ultimate repository. Concerns have been expressed about the potential effects of long-term exposure of bottom-dwelling organisms and ecosystems to these compounds. Effects may include both acute and chronic toxicity, mutagenicity and teratogenicity.

93. Aside from health risks which may be associated with direct or indirect exposure to marine contaminants, changing global conditions may cause the emergence or re-emergence of certain infectious diseases. Increases in sea-surface temperatures and sea-level could lead to a higher incidence of water-borne infectious and toxin-related illnesses, such as cholera and shellfish poisoning. Human susceptibility to infectious diseases might be further aggravated by malnutrition due to climate stress on fisheries production, and potential alteration in the human immune system caused by the increasing flux of ultraviolet radiation.

94. The possible use of the oceans as a repository for carbon dioxide is gaining advocates. Injecting carbon dioxide generated by the combustion of fossil fuels directly into the deep ocean and thus short-circuiting its gradual absorption from the atmosphere into the ocean, is considered as an option. Aside from technical, economic and legal problems, however, there are serious gaps in our understanding of the relevant natural biological, geochemical and physical processes, and of the biological effects that may be expected in the vicinity of release areas.

95. There have been suggestions that the oceanic uptake of carbon dioxide from the atmosphere, and possibly increased fish production could be enhanced by the artificial fertilization of large areas of naturally low productivity to stimulate phytoplankton production. The present state of knowledge is inadequate to predict how such deliberate large-scale eutrophication would impact on marine and coastal ecosystems.

96. Drilling for oil and gas has, in the past, been largely restricted to shallow nearshore and continental shelf areas. Recent technological developments have now made possible the exploration and exploitation of oil and gas deposits in increasingly deeper waters, currently down to about 2000 metres. Drilling in deep waters brings with it a number of increasingly serious hazards, also associated with drilling in shallow waters. Contamination from such drilling, including from the release of gas and oil, could affect large offshore areas and a deepwater blowout could be difficult to control quickly and efficiently. It would thus be very difficult to reduce the environmental effects, which may assume near-catastrophic proportions.

97. The exploitation of gas hydrates deposits found in deep oceans is a likely development in the decades to come. Producing gas hydrates would result in environmentally clean fuel (in comparison with oil or coal) but may lead to release of methane, which has a very strong greenhouse effect.

98. Improved technologies and changes in market value of minerals may trigger the large-scale extraction of certain minerals from the deep-sea floor, such as manganese nodules. This, in turn, could cause the extensive degradation of bottom ecosystems through direct physical disturbance, the resuspension of sediments and the discharge of pollutants from mining equipment.

99. Fishing in deeper waters is increasing, with the search for new stocks. Fishing in depths below 500 m for long-lived and slow-growing top predators of continental slope ecosystems (e.g., the orange roughy) is becoming more common and is leading to a rapid depletion of stocks. In deep-sea trawling,

there is a particular concern with the possible effect on deep-sea ecosystems which recover very slowly when disturbed. This concern stems from the level of depletion of biomass which is caused, not only by the removal of commercially valuable fish, but also by the by-catch, which may amount to more than half of the total catch.

100. Recent studies indicate an increase in coral diseases caused, in many parts of the world, by microbial and multicellular organisms. The factors contributing to the susceptibility of corals to such diseases, and to the loss of their pigments (the so-called "coral bleaching"), would have to be determined in order to prevent further deterioration of coral reefs.

101. Biological damage generally increases exponentially with decreasing wavelength within the UV-B radiation band. Consequently, small decreases in stratospheric ozone translate into rather large increases in biologically damaging radiation. More research is needed to assess the potential impact of increases in UV-B radiation on photosynthesis (i.e., phytoplankton productivity), as well as on the growth and reproduction of several marine species which, at least during part of their life-cycle, stay in near-surface waters.

102. Advances in modern molecular biology, genetics and genetic engineering have made it possible to alter the genetic structures of marine organisms. This progress in science and technology is expected to have a growing influence on marine aquaculture through the creation of fast-growing and disease-resistant strains of macroalgae, invertebrates and fish. The possible effects of accidentally or intentionally introduced genetically altered organisms on the gene pools, survival and overall health of wild populations of cultured species is causing some concern.

103. The market demand for certain marine products, such as reef-building and precious corals, shells, live reef fish and shark fin, is on the increase, stimulated by the trade in special marine products. In many places this is leading to severe overfishing and the serious destruction of habitats by, for instance, the excessive removal of corals for the curio trade and physical damage to the reef structure inflicted in the collection of live reef fish.

104. The predicted overall global warming of the Earth at a rate unprecedented in geological history is probably the most widely recognized issue associated with global change of the marine and coastal environment. Evidence is mounting that the world's climate is already changing, owing to the accumulation of greenhouse gases in the atmosphere. The most recent assessments suggest that, by the year 2100, the Earth could be warmer by up to 3.5 C, unless preventive measures are taken. By the same year, the average sea-level is expected to rise by 15-95 cm, with 50 cm as the most probable figure. The main effects of these changes on marine and coastal environment may include the following:

(a) Alterations in the flow of major ocean current systems, which may modify the distribution and composition of marine ecosystems with far-reaching ecological and economic consequences. The links between fish

abundance and distribution, and climate-related changes in oceanic conditions (e.g., El Niña, the advance of Atlantic waters into the south-east Atlantic and the reduction in salinity of the Baltic Sea) are today fully recognized;

(b) Diminution of the polar ice cover, which, coupled with stratospheric ozone depletion, may lead to major alterations in the spectral characteristics and intensity of incident light, which, in turn, may affect the timing and abundance of primary production;

(c) An increase in the number and intensity of extreme events, such as droughts, floods and hurricanes, whose consequences for marine and coastal natural and man-made systems may be considerable (i.e., damage to near-shore-and intertidal ecosystems, coastal installations, defence systems and harbours);

(d) Sea-level rise, mainly due to warming of the oceans, which will lead to the loss of low-lying coastal areas, and changes in wave regimes and patterns of coastal erosion. These will certainly affect coastal populations, settlements, industries, infrastructures, ecosystems and habitats. Flooding of sewerage systems, coastal industrial and power-generating plants will increase the risk of direct pollution.

105. Finding adequate responses to the environmental, social, economic and cultural impacts of the effects described above will, in the long term, be a major challenge facing the natural and human marine and coastal environment.

V. PROPOSALS FOR FUTURE UNEP ACTIONS TO ADDRESS THE ENVIRONMENTAL CHALLENGES OF CHAPTER 17

106. UNEP will strengthen the regional seas programme as its central mechanism for implementation of UNEP activities relevant to chapter 17, with a focus on the promotion of normative (i.e. policy-relevant) activities and implementation, in cooperation with Governments, intergovernmental, international and non-governmental organizations. In the framework of this programme, UNEP will promote the implementation of activities identified in six programme areas of chapter 17, specifically:

(a) Integrated management and sustainable development of coastal areas, by:

(i) Advancing the integrated management and sustainable development of coastal areas and associated river-basins as the overarching principle governing the activities of the programme;

(ii) Promoting the establishment of regional commissions for sustainable development;

(iii) Encouraging the reassessment of priorities within the regional components of the programme, with a view to ensuring that integrated management and sustainable development are their central issues;

(iv) Developing and testing guidelines for the environmentally sustainable management and use of coastal and marine resources, particularly through ICAM, based on drainage basin management units;

(v) Assisting countries in the development and strengthening of their institutional structures, legal instruments and manpower capacities needed for ICAM; and

(vi) Facilitating access to, and the transfer of, environmentally sound technologies;

(b) Marine environment protection, by:

(i) Promoting the formulation, adoption and implementation of appropriate technical, administrative and legal measures contributing to improved protection of the marine and coastal environment, including the rational use and conservation of their resources;

(ii) Facilitating and guiding, on a continuous basis, the assessment of the state of marine and coastal environment, including the trends of changes in this environment;

(iii) Fostering measures to minimize or prevent degradation of the marine environment from land-based and sea-based activities;

(c) Sustainable use and conservation of marine living resources under national jurisdiction, by:

(i) Promoting measures for improved protection of endangered species, fragile ecosystems, habitats and other ecologically sensitive areas, and for restoration of damaged systems and areas;

(ii) Pursuing the establishment of new, and the expansion of existing, specially protected areas;

(iii) Fostering closer cooperation between the programme and mechanisms and bodies dealing with fisheries, including aquaculture;

(iv) Exploring the possibilities of integrating fisheries-related issues into the programme;

(d) Addressing critical uncertainties for the management of the marine environment and climate change, by strengthening and expanding the ongoing research, monitoring and observation activities undertaken in the framework of the programme;

(e) International, including regional, cooperation and coordination, by:

(i) Acting as a clearing-house for the collection and exchange of information relevant to the activities pursued under the programme;

(ii) Convening, on a regular basis, periodic meetings of secretariats of the regional components of the programme, including those not directly coordinated by UNEP, and representatives of organizations supporting the programme, to discuss and determine areas of possible cooperation;

(iii) Coordinating activities jointly undertaken by the regional components of the programme;

(iv) Ensuring that the programme is developing in harmony with relevant global programmes, legally non-binding agreements and conventions, particularly those for which UNEP acts as the secretariat;

(v) Fostering increased cooperation with, and the active involvement of, international and intergovernmental and nongovernmental organizations in the programme;

(vi) Preparing and convening, possibly in 2000, a joint high-level meeting of the representatives of the governing bodies (e.g., parties to the conventions) of the regional components of the programme, to review overall progress in the programme and to determine ways and means of enhancing its contribution to the global protection of the marine and coastal environment through regional and interregional cooperation;

(f) Sustainable development of small islands, by pursuing the specific goals of the Programme of Action for the Sustainable Development of Small Island Developing States in all appropriate regions covered by the regional seas programmes.

107. UNEP will also explore the need and possibility for expansion of the regional seas programme to geographical areas currently not covered.

108. In addition, in order to further the principles and goals of chapter 17, UNEP will continue contributing to the implementation of Agenda 21 through the following:

(a) Ongoing UNEP programme elements and activities, such as GEMS, GRID and INFOTERRA;

(b) Programmes for which UNEP acts as secretariat, coordinator or lead agency, such as Earthwatch, the Global Plan of Action for the Conservation, Protection and Utilization of Marine Mammals and the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities;

(c) GEF, by pursuing the development of projects contributing to improved management of the marine and coastal environment, and by coordinating the implementation of GEF-supported projects for which UNEP has assumed direct responsibility, such as the Global International Waters Assessment;

(d) Global conventions for which UNEP provides the secretariat, such as CITES, the Convention on the Conservation of Migratory Species, the Basel Convention and the Convention on Biological Diversity;

(e) GESAMP, by, first, leading and supporting the preparation of periodic global assessments of the state of the marine environment and a global assessment of the impact of land-based activities on the marine environment, based on the series of regional reports prepared under the Global Programme of Action, and, second, initiating the review of the terms of reference, composition and methods of work of GESAMP, with a view to improving its effectiveness and comprehensiveness, while maintaining its status as a source of agreed, independent scientific advice, as called for by decision 6/1 of the Commission on Sustainable Development, and subsequently requested by the Governing Council of UNEP; and

(f) Programmes and activities co-sponsored by UNEP together with other organizations, such as the Programme of Action for the Sustainable Development of Small Island Developing States, IPCC, ICRI, GOOS, GIPME and WCP.